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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/626,330 | 07/24/2003 | David J. Christie | AE2002-006CIP | 1361 |
| 35487 | 7590 | 05/23/2006 | EXAMINER | |
| JOHN D. PIRNOT ADVANCED ENERGY INDUSTRIES, INC. 1625 SHARP POINT DR. FORT COLLINS, CO 80525 | | | MCDONALD, RODNEY GLENN | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 1753 | |

DATE MAILED: 05/23/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

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|------------------------------|------------------------|--|---------------------|--|
| Office Action Summary | Application No. | | Applicant(s) | |
| | 10/626,330 | | CHRISTIE, DAVID J. | |
| | Examiner | | Art Unit | |
| | Rodney G. McDonald | | 1753 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 March 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-8 and 10-12 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-8 and 10-12 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 4-8 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chistyakov (U.S. Pat. 6,896,773) in view of Kouznetsov et al. "A novel pulsed magnetron sputter technique utilizing very high target power densities", Surface and Coatings Technology 122 (1999) 290-293 and Manley et al. (U.S. Pat. 5,682,067).

Regarding claims 1, 8, Chistyakov teach in Fig. 4 an apparatus and method for sputter deposition by providing a plasma chamber 202 with a sputtering gas source 208 for providing the sputtering gas. The chamber includes a sputtering target 220 for depositing material on the substrate. A pulsed power supply 234 is provided. The pulsed power source 234 can generate a weakly ionized plasma and subsequently generate a highly ionized plasma avoiding arc discharge. The target is sputtered to form a film on the surface of the substrate. (See Fig. 4; Column 5 lines 60-68; Column 6 lines 11-32; Column 6 lines 40-47; Column 7 lines 53-61; Column 8 lines 53-57; Column 8 lines 65-68; Column 9 lines 1-12; Column 9 lines 42-54; Column 3 lines 12-16) The voltage rate of rise of the voltage pulse is controlled to avoid adopting an arc

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state and produces a highly ionized plasma. (Fig. 6; Column 14 lines 64-67; Column 15 lines 1-65)

Regarding claims 5, 11, the magnitude of the voltage pulse is limited to prevent arc discharge. (Column 14 lines 64-67; Column 15 lines 1-65)

The differences between Chistyakov and the present claims is that the pulse power source being a DC power source is not discussed (Claim 1), the peak power density is not discussed (Claim 2), controlling the voltage rate of rise of the voltage pulse by utilizing a circuit comprising a resistor in series with a capacitor (Claim 4, 10), controlling the magnitude of the voltage pulse by utilizing a circuit comprising a resistor in series with a capacitor is not discussed (Claim 6, 10) and where the magnitude of the voltage pulse is limited using a circuit comprising a reverse biased diode, a capacitor, and a clamp voltage supply is not discussed (Claim 7, 12).

Regarding the pulse power source being a DC power source of claim 1, Kouznetsov et al. teach providing a plasma chamber with a sputtering of argon therein. A material target of copper is provided. A DC pulsed power supply was applied to the target in order to ionize a significant amount of copper (about 70%). The copper is deposited on substrate holders. (See page 290, 291, 293) Kouznetsov et al. teach the DC pulse power delivers power pulses up to 2.4 MW and has target power densities of 0.6-2.8 kW/cm². (See Page 291)

Regarding claim 2, Kouznetsov et al. teach that the target power densities can be 0.6-2.8 kW/cm². (See Page 291)

The motivation for utilizing a DC pulsed power with particular target densities is that it allows for filling high aspect ratio holes. (See Kouznetsov abstract)

Regarding the circuit comprising a resistor in series with a capacitor for controlling the voltage rate of rise of the voltage pulse of claims 4 and 10, Manley et al. suggest capacitor 32 and resistor 38 for controlling the voltage. (Column 4 lines 3-16)

Regarding the circuit comprising a resistor in series with a capacitor for controlling the magnitude of the voltage pulse of claims 6 and 10, Manley et al. suggest a capacitor 30 and diode 34 for limiting the voltage. (Column 4 lines 31-35)

Regarding the use of a circuit comprising a reverse biased diode, a capacitor and a clamp voltage supply for limiting the voltage of claims 7 and 12, Manley suggest a capacitor 30, a diode 34 and clamping voltage (i.e +/-) for limiting voltage. (Column 4 lines 31-35; Column 11 lines 55-58)

The motivation for providing a circuit comprising a resistor in series with a capacitor for controlling the voltage rate of rise of the voltage pulse, for providing a circuit comprising a resistor in series with a capacitor for controlling the magnitude of the voltage pulse and for using a circuit comprising a reverse biased diode, a capacitor and a clamp voltage supply for limiting the voltage is that it allows for limiting the voltage applied to an electrode. (Column 4 lines 31-35)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Chistyakov by utilizing a dc pulse power source and a particular power density as taught by Kouznetsov and to have provided a circuit comprising a resistor in series with a capacitor for controlling the voltage rate of

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rise of the voltage pulse, to have provided a circuit comprising a resistor in series with a capacitor for controlling the magnitude of the voltage pulse and utilized a circuit comprising a reverse biased diode, a capacitor and a clamp voltage supply for limiting the voltage as taught by Manley et al. because it allows for filling high aspect ratio holes and for limiting the voltage applied to an electrode.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 8 and 10-12 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-7 of U.S. Patent No. 6,808,607 in view of Chistyakov (U.S. Pat. 6,896,773).

Claims 1-7 of U.S. Pat. No. 6,808,607 teach a plasma chamber, a material target, a DC pulsed power supply, and a pulsing circuit with pulse shaping means.
(Claims 1-7)

The differences between U.S. Pat. No. 6,808,607 and the present claims is that the ionizing without first adopting an arc discharge state is not discussed.

Chistyakov is discussed above and teach achieving a highly ionized state without first adopting an arc discharge state. (See Chistyakov discussed above)

The motivation for achieving a highly ionized state without first adopting an arc discharge state is that it allows for increasing sputtering rate. (Column 2 lines 38-56)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified U.S. Pat. 6,808,607 by achieving a highly ionized state without first adopting an arc discharge state as taught by Chistyakov because it allows for increasing sputtering rate.

Response to Arguments

Applicant's arguments filed 3-8-06 have been fully considered but they are not persuasive.

In response to the argument that the prior art of record does not teach a state of ionization substantially higher than that of an abnormal glow discharge be adopted without first adopting an arc discharge state by controlling the voltage rate of rise of the voltage pulse applied to the material target, it is argued that Chistyakov teach generating a weakly ionized plasma and subsequently generating a highly ionized plasma (this is considered to be the state of ionization substantially higher than that of abnormal glow discharge) avoiding arc discharge. This is done by controlling the rate of rise of the voltage pulse applied to the target so that an arc discharge is eliminated from going from the weakly ionized plasma to the highly ionized plasma. (See Chistyakov discussed above; Chistyakov Column 15 lines 12-20)

In response to the argument that the double patenting rejection should be withdrawn because the prior art of record does not teach a state of ionization substantially higher than that of an abnormal glow discharge be adopted without first adopting an arc discharge state by controlling the voltage rate of rise of the voltage pulse applied to the material target, it is argued that Chistyakov as discussed above do teach the required control of the voltage rate of rise to eliminate arcing to produce a highly ionized plasma. (See Chistyakov discussed above)

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
May 18, 2006